SYSTEM AND METHOD TO CHANGE A CONTACT POINT OF THE MUSCULAR-SKELETAL SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. provisional patent application No. 61/803,078 filed 18 Mar. 2013. The disclosure of which is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

The invention relates in general to medical and surgical procedures and more particularly to aligning medical devices to precise locations on or within a patient's body.

BACKGROUND OF THE INVENTION

Orthopedic alignment currently involves cycles of trial and error. For example, leg alignment requires a technique that approximates alignment in which the surgeon makes one of the distal femoral cut and the proximal tibial cut based on experience, mechanical jigs, and visual alignment. Typically, the proximal tibial cut is made so as to remove the least amount of the proximal tibia, while ensuring sufficient removal of diseased or otherwise undesirable bone. The remaining femoral cuts are made to complete shaping of the femur to receive a femoral prosthesis. After the femoral and tibial cuts are complete, the femoral prosthesis and the tibial prosthesis, or trial versions thereof, are temporarily implanted and the surgeon reviews leg alignment. Typically, no adjustments are made if the leg is within a few degrees varus or valgus of the mechanical axis. An insert has a bearing surface that allows articulation of the leg. A set of shims can be coupled to the insert. The shims are used to change the thickness of the insert. A shim and insert combination is chosen that produces the best subjective movement characteristics of the joint through a full the range of motion. The surgeon may modify the bone or perform soft tissue tensioning to affect load, rotation or alignment characteristics. In general, the implant procedure is performed using the subjective skills of the surgeon to achieve appropriate leg alignment, rotation, balance, and soft tissue tension-loading.

Even with mechanical jigs, trialing, and advanced prosthetic components, outcomes including functional efficacy, patient comfort, and longevity of the prosthesis may not always be highly predictable, especially if procedures are performed by physicians and surgeons with different levels of skill, experience, and frequency of repeating an individual procedure. This may be confirmed by various reports in the literature that suggest a positive relationship between outcomes and the numbers of procedures performed annually by individual surgeons.

Accurately determining and aligning an implant orientation is a difficult process requiring expensive equipment. A simple, efficient method is needed to reduce medical costs and time of the surgical procedure, while maintaining accuracy.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

FIG. **1**A illustrates a simplified view of directions of motion referred to herein;

FIG. **1**B illustrates the comparison between vargus and valgus;

FIG. **10** illustrates a simplified view of a physician using at least one embodiment of a motion and orientation sensing device (e.g., a surgical tracking system) with a computer display (e.g., a surgical tracking display system);

FIG. **2** illustrates a top view of a tibia and associated reference axis;

FIG. **3** illustrates a side view of a tibia and associated reference axis;

FIG. **4** illustrates a user obtaining a reference axis by moving a sensor;

FIG. **5** illustrates a user obtaining an alignment by moving an orthopedic system;

FIG. **6** illustrates a user obtaining alignment data using a sensor;

FIGS. **7** and **8** illustrates a user moving an orthopedic system in extension to obtain alignment data;

FIGS. **9** and **10** illustrates a user moving an orthopedic system in flexion to obtain alignment data;

FIGS. **11** and **12** illustrates a user moving an orthopedic system in flexion to obtain alignment data

FIGS. **13** and **14** illustrates a user moving an orthopedic system in elevated extension to obtain alignment data;

FIG. **15** illustrates a user moving an orthopedic system in elevated extension to obtain alignment data;

FIG. **16** illustrates an electronic display showing a schematic of a sensor, with orthopedic parametric values and a display of the orthopedic system;

FIGS. **17-36** illustrates portions of a software display of a user assist computer program;

FIGS. **37-38** illustrates various device zeroing configurations;

FIG. **39** illustrates a device orientation to obtain reference axis data;

FIG. **40** illustrates an adapter and device that can be coupled to a cutting jig;

FIG. **41** illustrates the adapter and device coupled together;

FIG. **42** illustrates a cutting jig and the associated adapter and sensor device;

FIG. **43** illustrates an incorporated cutting jig system including the adapter and sensor device;

FIG. **44** illustrates the incorporated cutting jig system in a cutting position in an extended orthopedic system;

FIG. **45** illustrates the incorporated cutting jig system in a cutting position in a flexion orientation, changing vargus and valgus of the cutting jig;

FIG. **46** illustrates the incorporated cutting jig system in a cutting position in an extension system, changing the A-P angle of the cutting jig;

FIG. **47** illustrates two cutting jig systems being aligned;

FIG. **48** illustrates a femur rotation guide;

FIG. **49** illustrates using the femur rotation guide to adjust condial orientation;

FIG. **50** illustrates a tibia reference tool used for alignment;

FIG. **51** illustrates another view of the tibia reference tool used for alignment;

FIG. **52** illustrates a method of measuring joint alignment between first and second bones;

FIG. **53** illustrates another method of measuring joint alignment between first and second bones;

FIG. **54** illustrates another method of measuring joint alignment between first and second bones;

FIG. **55** illustrates a method of measuring alignment of a tibia to a mechanical axis of a leg;